THE ABSORPTION OF MOISTURE BY WHEAT GRAIN AND ITS RELATION TO THE HUMIDITY OF THE ATMOSPHERE.

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(*Read 9th March*, 1920.)

In the commercial world, it is a matter of common knowledge that wheat purchased immediately after harvest will gain in weight until and during the Winter. It was believed that the increase in weight was due to the absorption by the grain, of moisture from the atmosphere, but nothing definite was known regarding the amount of gain to be expected or when such occurred. With the object of gaining some information regarding these points, some experiments were conducted with small parcels of grain, the objects of the experiment being—

1. To ascertain the variations which take place in the moisture content of a parcel of wheat during a calendar year.

2. To ascertain whether constant and definite variations in their moisture content exist between varieties of different types, also between the same varieties when grown under different climatic conditions.

3. To ascertain whether there is any correlation between the moisture content of the wheat, and the relative humidity of the air.

The experiments were commenced during January, 1919, when samples of three varieties of wheat were obtained shortly after being harvested, from the School of Agriculture at Narrogin and the Experiment Farms at Merredin and Chapman. These localities are representative of widely separate districts within the wheat belt. The Chapman Farm is situated near its northern limit, it is about 35 miles north of Lat. 29° South and about 15 miles in an easterly direction from the sea (about 25 miles north from Geraldton and 260 miles from Perth). It has an elevation of about 500 feet above sea level. The Merredin Farm is on the eastern fringe of the Wheat Belt. It is situated 35 miles north of Lat 32° south and is about 160 miles from the sea in an easterly direction from Perth. It has an elevation of about 1,000 feet. The Narrogin School of Agriculture is on the western fringe. It is about 100 miles south-east from Perth and is situated about 65 miles south of Lat. 32° south and 90 miles east from the sea. It has an elevation of 1,200 feet above sea level.

During the harvest months the mean average shade temperatures recorded respectively at the three farms were as follows :—

——	Chapman.	Merredin.	Narrogin.
	Degrees Fahrenheit.		
Mean Maximum Temperature (shade)—			
November	83·6	84·4	78·7
December	89·0	89·8	84·3
January	92·7	92·9	87·1
Mean Minimum Temperature (shade)—			
November	56·2	52·8	50·5
December	59·7	56·7	53·6
January	63·2	60·7	56·6

The varieties of wheat chosen were "Federation" representing the soft white type of wheat ; "Bunyip" the straight grade or harder type, and "Comeback" the Australian strong hard white type. About 15lb. of the grain of each variety of wheat were obtained during January, and shortly after being harvested. Each parcel as taken was placed in a jute grain sack in which it remained during the course of the experiment and from which the samples required for the moisture determinations have been obtained.

So as to ascertain the moisture content of the wheat as freshly harvested, about 200 grammes were placed direct from the harvester into a lever top tin and sealed. The moisture content of these samples was determined on 21st January, 1919. It was intended to have had samples taken and moisture determinations made at monthly intervals from that date, but difficulty was experienced in obtaining suitable storage in close proximity to instruments by which the relative humidity of the air surrounding the wheat could be taken. Eventually arrangements were made to store the wheat in a small open-fronted galvanised iron shed (the sides and roof being iron) at my residence adjacent to the Swan River, Mt. Lawley, near Perth, and through the courtesy of Mr. Curlewis, Commonwealth Meteorological Officer, wet and dry bulb thermometers were installed adjacent to the stored wheat. The thermometers were set up on 15th June, 1919.

The second samples for moisture determination were taken a week later on 24th June, 1919, and afterwards at monthly periods. The samples on being taken were immediately placed in lever top tins, sealed for transport to the laboratory, where the moisture determinations were made by the co-operation of the Government Analyst and Agricultural Chemist (Mr. E. A. Mann), who has informed me that "the moisture determinations appearing in this paper have all been made in an air oven on whole grain subjected to a temperature of 130° C. for eight hours."

The following table has been prepared from his reports :—

TABLE I.

Monthly Variations in the Porcentage of Moisture Content of Wheat.

Date of Determination.	From Chapman.				From Merredin.				From Narrogin.				General Average.			
	Bunyip	Come-back.	Federation.	Average.	Bunyip.	Come-back.	Federation.	Average.	Bunyip.	Come-back.	Federation.	Average.	Bunyip.	Come-back.	Federation.	Average.
Sealed Sample from Farm—21st January, 1919	9·2	9·7	10·6	9·83	8·92	8·82	7·95	8·56	9·0	11·2	8·6	9·60	9·04	9·91	9·05	9·33
Monthly Analysis—June 24, 1919 ...	12·35	12·52	13·52	12·80	10·85	12·15	11·80	11·60	11·55	12·35	12·22	12·04	11·58	12·34	32·51	12·14
July 28, 1919	14·80	14·08	15·13	14·67	14·44	15·21	13·77	14·47	12·98	13·82	14·37	13·72	14·07	14·37	14·42	14·29
August 24, 1919 ...	15·13	14·95	15·39	15·16	15·06	14·22	14·74	14·67	14·41	14·97	14·40	14·59	14·87	14·71	14·84	14·81
September 24, 1919 ...	14·30	14·76	14·66	14·57	15·78	15·88	15·48	15·71	14·60	15·02	16·38	15·33	14·89	15·22	15·51	15·21
October 25, 1919 ...	13·04	13·99	13·30	13·44	13·80	13·73	12·48	13·34	12·43	13·35	13·74	13·17	13·09	13·69	13·17	13·32
November 25, 1919 ...	13·10	13·34	12·54	12·99	14·41	13·90	13·97	14·09	14·22	13·19	12·74	13·38	13·91	13·48	13·08	13·49
December 25, 1919 ...	14·49	13·45	14·17	14·04	14·33	12·89	13·34	13·52	13·06	13·65	12·79	13·17	13·96	13·33	13·43	13·57
January 25, 1920 ...	12·00	11·46	12·36	11·94	11·49	11·27	11·27	11·34	10·29	10·07	10·14	10·17	11·26	10·93	11·26	11·15
*February 25, 1920 ...	13·39	12·78	13·76	13·31	13·43	14·02	14·03	13·83	12·18	12·61	12·62	12·47	13·00	13·14	13·47	13·20
*March 21, 1920 ...	12·48	13·28	13·15	12·97	13·43	12·37	13·30	13·03	12·25	11·62	11·61	11·83	12·72	12·42	12·69	12·61
*April 25, 1920 ...	11·69	11·54	14·43	12·55	11·56	14·61	12·47	12·88	12·38	14·43	13·31	13·37	11·88	13·53	13·40	12·94
*May 25, 1920 ...	14·52	15·65	14·51	14·89	15·46	15·62	14·01	15·03	14·35	14·67	16·02	15·01	13·78	15·31	14·85	14·65
*June 25, 1920 ...	16·13	16·03	16·13	16·11	16·30	16·42	16·76	16·49	15·15	15·40	15·97	15·51	15·86	15·95	16·30	16·04

*Recorded subsequent to the reading of the Paper.

THE VARIATIONS IN THE MOISTURE CONTENT THROUGHOUT THE YEAR.

It is at once seen from Table I. that the wheat as harvested on the farm contains a very small amount of moisture, the mean for all varieties and all farms being 9·33 per cent. This is not quite as dry as freshly harvested Indian (Punjab) wheat which contains about 8·8* per cent. moisture, but is considerably below the standard prescribed for the highest grade of American wheat, viz., 13·50 per cent. As was to be expected the wheat from the interior farm at Merredin contained the least moisture and that from the northern farm, which is the nearest to the sea, slightly the most. By June the mean moisture content had increased to 12·14 per cent., a gain of 2·81 per cent. Then followed a monthly gain until September when the total mean gain amounted to the large amount of 5·88 per cent. with a moisture content of 15·21 per cent.

Following upon the maximum increase in weight there is then a gradual monthly decline until at the end of twelve months in January the mean moisture content has fallen to 11·15 per cent. or 1·82 per cent. in excess of the moisture content of the same wheat as found on the farms. It is concluded from this that, consequent upon the protection from the direct drying action of the sun's rays afforded by the sack with which the wheat is covered that the moisture content of stored wheat will not fall again to the same low level of the wheat as found in the harvest field.

These results are at entire variance with those obtained by Barnes and Grove at Lyallpur. In order to compare the amount of moisture contained in wheat during the moist months of July and August when the monsoon is in progress, with that in freshly harvested wheat in May, these investigators purchased samples of both hard and soft wheat from week to week during the months of July, August, September, and October in the Lyallpur bazaar market. The moisture in wheat freshly harvested in May was found to be—Hard Wheat, 8·7 per cent., Soft Wheat 8·8 per cent. The moisture content found in the purchased samples fluctuated irregularly throughout the period. In the case of soft bazaar wheat, the range was from 7·86 per cent. to 11·05 per cent. In the case of the hard wheat the range was from 8·17 per cent. to 10·62 per cent.

The writers state that the results obtained show the moisture content of the wheat has not advanced to any considerable extent over that of the recently harvested grain in May, and finally it is stated, "We conclude therefore that ordinarily speaking wheat is not a hygroscopic susbtance and cannot take up much more moisture than it contains at harvest time, the time when wheat is at its

*Barnes & Grove. The insects attacking stored wheat in the Punjab.

driest, and that moisture in the wheat is not the important factor in insect attack. Our results for the moisture content of wheat do not agree with those quoted by Fletcher."

It is not stated how the parcels from which the samples were taken had been stored or whether all had been stored in the same way. The lack of this information together with the obvious fact that the samples were not all from the same bulk, makes it very difficult for others than the investigators to draw any conclusions. It is believed, however, that though the differences found by them may not be sufficient to be the important factor in insect attack, yet the differences of 3·19 per cent. in the case of soft wheat and of 2·45 per cent. for hard wheat between the minimum and maximum moisture content, are sufficient to indicate that Indian wheat is hygroscopic and will absorb moisture from the atmosphere, as was found to be the case in the experiments now being discussed.

THE VARIATIONS IN THE MOISTURE CONTENT OF THE DIFFERENT VARIETIES.

From an examination of the results recorded in Table I, it is very evident that the variations between the moisture content of the different varieties are not at all constant. For instance, at the Chapman Farm "Bunyip" was found to contain the least moisture in January, June, September, and October; "Comeback" in July, August, December, and January, and "Federation" in November. Similar instances will be found in connection with the varieties from the other farms.

Nor is there any agreement between the moisture content of the same variety from the different places. This is shown by the following instances:—When harvested the varieties containing the least moisture were at Chapman "Bunyip," at Merredin and Narrogin "Federation." In June when the next determinations were made, the variety containing the least moisture was "Bunyip" at all farms. In July the variety was "Bunyip" at Chapman and Narrogin and "Federation" at Merredin. In August it was "Comeback" at Chapman and Merredin, and "Federation" at Narrogin. It is probable that the experiment was not delicate enough to bring out these points and for this purpose laboratory tests are probably necessary. Attempts were made to arrange laboratory tests which would provide information on this and other related matters but unfortunately these attempts were unsuccessful.

RELATION OF MOISTURE CONTENT TO RELATIVE HUMIDITY.

Following the installation of the wet and dry bulb thermometers, daily readings at 9 a.m. and 3 p.m. have been taken in

accordance with the usual custom, and from these the relative humidity has been calculated. The details of this are given in Table II. hereunder in which the mean humidity for one, two, three, and four weekly periods preceding the date on which the samples for moisture determinations were obtained.

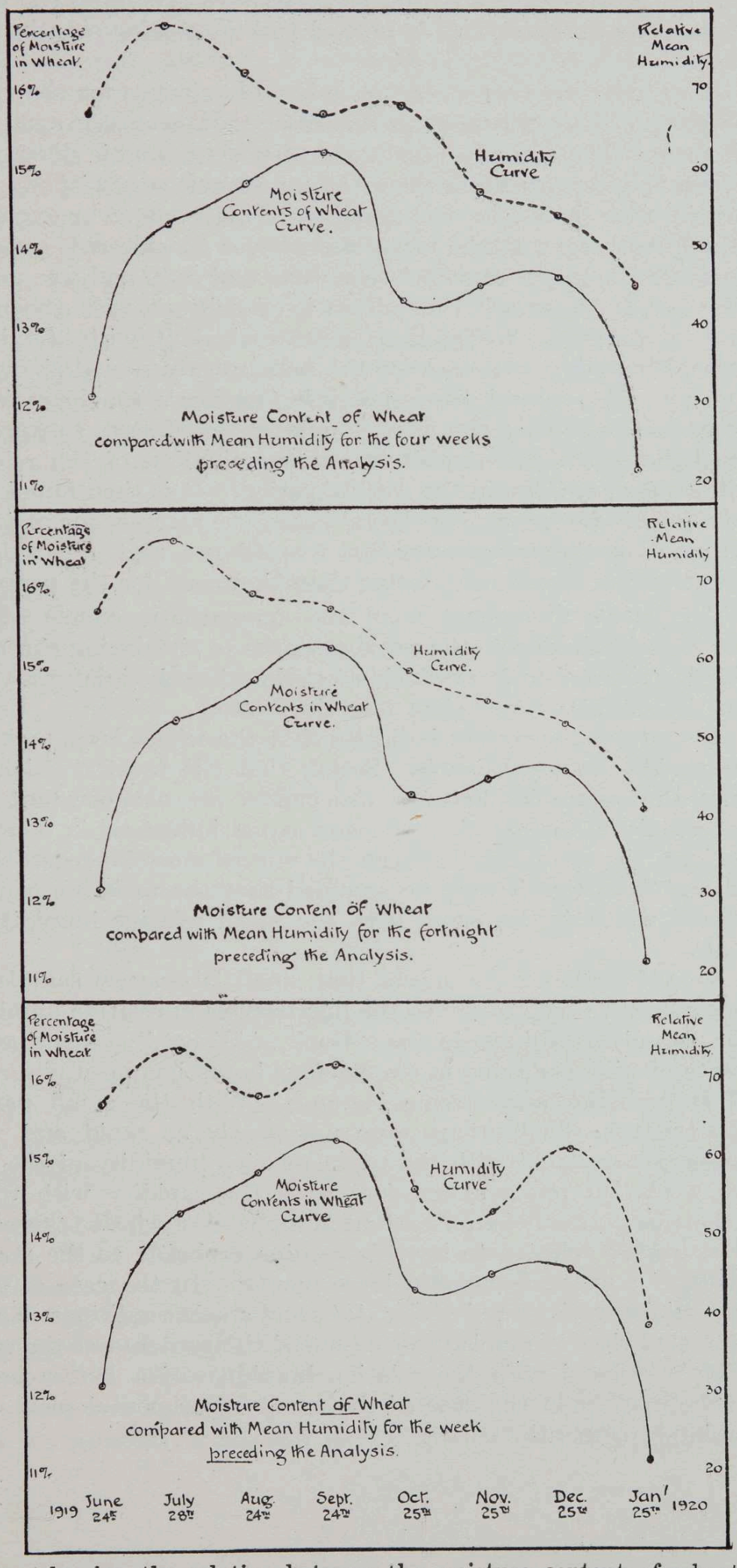
TABLE II.

Mean Humidity for the periods indicated to which Samples of Wheat were subjected prior to Samples being Tested for Moisture Content.

Sample taken on	Period.			Dry Bulb.			Wet Bulb.			Mean Humidity for Period.
	From.	To.	Days.	a.m.	p.m.	Mean.	a.m.	p.m.	Mean.	
1919.										
June 24	June 18	June 24	7	54·2	66·0	60·1	51·1	57·9	54·5	67
	July 1	July 28	28	56·7	65·9	61·3	54·8	60·2	57·5	78
	July 8	July 28	21	56·4	65·2	60·8	54·4	59·2	56·8	76
	July 15	July 28	14	57·7	65·9	61·8	55·3	59·8	57·6	76
July 28	July 22	July 28	7	57·7	64·2	61·0	54·9	58·0	56·5	74
	July 29	Aug. 24	27	54·8	64·7	59·8	51·7	58·0	54·9	72
	Aug. 4	Aug. 24	21	55·8	65·3	60·6	52·6	58·7	55·7	71
	Aug. 11	Aug. 24	14	55·2	66·2	60·7	51·8	58·7	55·3	69
Aug. 24	Aug. 18	Aug. 24	7	57·6	68·3	63·0	53·4	60·9	57·2	68
	Aug. 28	Sept. 24	28	58·9	65·4	62·4	54·7	58·4	56·6	67
	Sept. 4	Sept. 24	21	60·3	66·9	63·6	55·4	59·1	57·3	66
	Sept. 11	Sept. 24	14	61·4	66·7	64·1	56·1	59·8	58·0	67
Sept. 24	Sept. 18	Sept. 24	7	63·1	66·0	64·6	58·7	59·8	59·3	72
	Sept. 28	Oct. 25	28	62·7	66·0	64·4	56·9	60·3	58·6	68
	Oct. 5	Oct. 25	21	62·8	68·6	65·7	56·8	60·2	58·5	62
	Oct. 12	Oct. 25	14	63·8	70·5	67·2	57·2	61·2	59·2	59
Oct. 25	Oct 19.	Oct. 25	7	64·6	71·9	68·3	56·8	62·3	59·6	56
	Oct. 29	Nov. 25	28	69·6	74·8	72·2	61·5	64·2	62·9	57
	Nov. 5	Nov. 25	21	71·4	77·9	74·7	62·7	66·1	84·4	54
	Nov. 12	Nov. 25	14	72·5	78·5	75·0	63·0	66·3	64·7	55
Nov. 25	Nov. 19	Nov. 25	7	74·1	79·9	77·0	64·5	67·7	66·1	53
	Nov. 28	Dec. 25	28	76·6	78·9	77·8	66·2	67·6	66·9	54
	Dec. 5	Dec. 25	21	77·3	79·6	78·5	66·6	68·3	67·5	54
	Dec. 12	Dec. 25	14	77·6	79·5	78·6	66·2	67·6	66·9	52
Dec. 25	Dec. 19	Dec. 25	7	74·9	77·7	76·3	64·3	65·7	65·0	61
	Dec. 29	Jan. 25	28	83·1	91·5	87·3	70·2	74·0	72·1	45
1920.	Jan. 5	Jan. 25	21	83·5	92·7	88·1	69·6	74·1	71·9	43
	Jan. 12	Jan. 25	14	84·7	94·1	89·4	69·6	74·5	72·1	41
Jan. 25	Jan. 19	Jan. 25	7	88·1	98·7	93·4	71·4	76·8	74·1	38

From this data it will be seen that for the period under review the maximum humidity occurs early in July, and from that date there has been an almost consistent decline in the relative humidity until 25th January, with a specially rapid decline during the last month, when for the last period it was 38 per cent. or "dry." In order to ascertain if any relation existed between the relative humidity and the moisture content of the grain, curves have been plotted showing the variations which have occurred. In the case of the relative humidity, these are for periods of one, two, and four weeks preceding the moisture determinations. These are as follow :—

Fig. 11.



Curves showing the relation between the moisture content of wheat and the relative humidity of the air, June, 1919—January, 1920.

Another curve for a period of three days preceding the determinations was plotted, but it proved to be out of sympathy with them.

It will be seen that the relative humidity curve for the period of a week preceding the moisture determinations is most in sympathy with them. There are two instances of unsympathetic divergence. The first is in August when the moisture content curve fails to drop relatively with the fall in the humidity. This seems to be explained by the hypothesis that the wheat absorbed a considerable quantity of moisture, 2·15 per cent. between June and July and was unable in the period to absorb the full ratio consistent with the mean degree of humidity recorded or even consistent with the lower degree of humidity recorded for the next weekly period shown on the graph. The second divergence is in October when the moisture content fell lower than the mean humidity would seem to warrant. Some light is thrown on this by an examination of the relative humidity for each day in the weekly period. It is then found that on the fourth day preceding the taking of the samples for moisture determination the mean humidity was 42 per cent. This is an extreme and is 14 per cent. lower than the mean for the period.

This latter divergence from the sympathetic course of the curve is probably due to the rapid response to the drying character of the day referred to from which effect the wheat had not recovered when the samples were taken four days later.

A study of the results indicates that the wheat loses moisture more rapidly than it gains it. Seeing that the factors which influence the sympathy between the curves are not constant and if antagonistic factors do not exert equal influences in opposite directions, the sympathy between the curves must be regarded as good and from this it may be assumed that the moisture content of stored wheat is correlated with the mean relative humidity of the air.

Several writers have stated that small laboratory samples of wheat respond very rapidly to the fluctuations in relative humidity of the air and, Dondlinger in the "Book of Wheat," states than an increase of nine per cent. in twenty-four hours has been observed. This is probably an extreme instance. With the small parcels under trial the fluctuations were not nearly as rapid and were apparently correlated with the mean relative humidity of the previous week. It appears therefore as if the rapidity with which the changes in the moisture content of a parcel of wheat take place, has an inverse relation to its volume, due probably to the greater difficulty for air movement in large masses. In the case of large commercial parcels stored under the usual stack conditions, it may be assumed that the moisture content of the contents of the stack will be correlated with the relative humidity of a longer period than the week as in the case of the small experimental plots, and is probably a month.

The shape of the curve based upon the experimental results from June to September indicates that the gains during this period are cumulative and that in consequence large parcels of stored wheat will continue to gain moisture until the maximum is reached about October. In this State this maximum may be expected to be between five and six per cent. The curve from September to January indicates a slow decline until December with a rapid one in January, 1920. This month was remarkable for high temperatures and low humidity. During the weekly period prior to the samples being taken, the afternoon temperature ranged from 97·2 to 102 F. with five days over 101. This is unusual. From this it may be reasonably assumed that there will be a gradual decline in the moisture content of stored wheat, until in the middle of Summer it is between eleven and twelve per cent.

The fact that the moisture content of wheat and consequent increase or reduction in weight is correlated with the relative humidity, has an important commercial aspect, seeing that the bulk of the wheat grown in Australia in a normal season is shipped to Great Britain. The mean average humidity of London has been kindly supplied by the State Meteorologist (Mr. E. B. Curlewis), and is as follows :—

January	87	per cent.
February	85	,,
March	80	,,
April	75	,,
May	69	,,
June	69	,,
July	68	,,
August	74	,,
September	78	,,
October	80	,,
November	88	,,
December	87	,,

From this it will be seen that the minimum humidity for London is almost equal to our maximum and that in consequence any wheat shipped from this State can be expected to increase by some five per cent. above the weight as found in the harvest field. This increase in weight will compensate for losses which occur in transit and should assist in reducing the costs connected therewith.

Summarised, the results of this experiment show :—

1. That West Australian wheat as harvested is "very dry," though not as dry as Indian (Punjab) wheat but contains about four per cent. less moisture than the standard 13·50 per cent. prescribed for the highest grade American wheat.

2. That wheat as harvested regularly absorbs moisture and increases in weight until about October when the increase may be expected to amount to between five and six per cent.

3. It then loses moisture until January but does not become as dry as when harvested, the percentage increase above that period being about two per cent.

4. That if constant and definite variations in their moisture content exist between varieties of different types or between the same varieties from different districts, these experiments were not sufficiently delicate to demonstrate them.

5. That there is a correlation between the moisture content of wheat after harvest and the relative humidity of the air. In the case of the small experimental lots it is apparently correlated with the mean of a week. In the case of large parcels it is probably correlated with the mean of about a month.

APPENDIX.

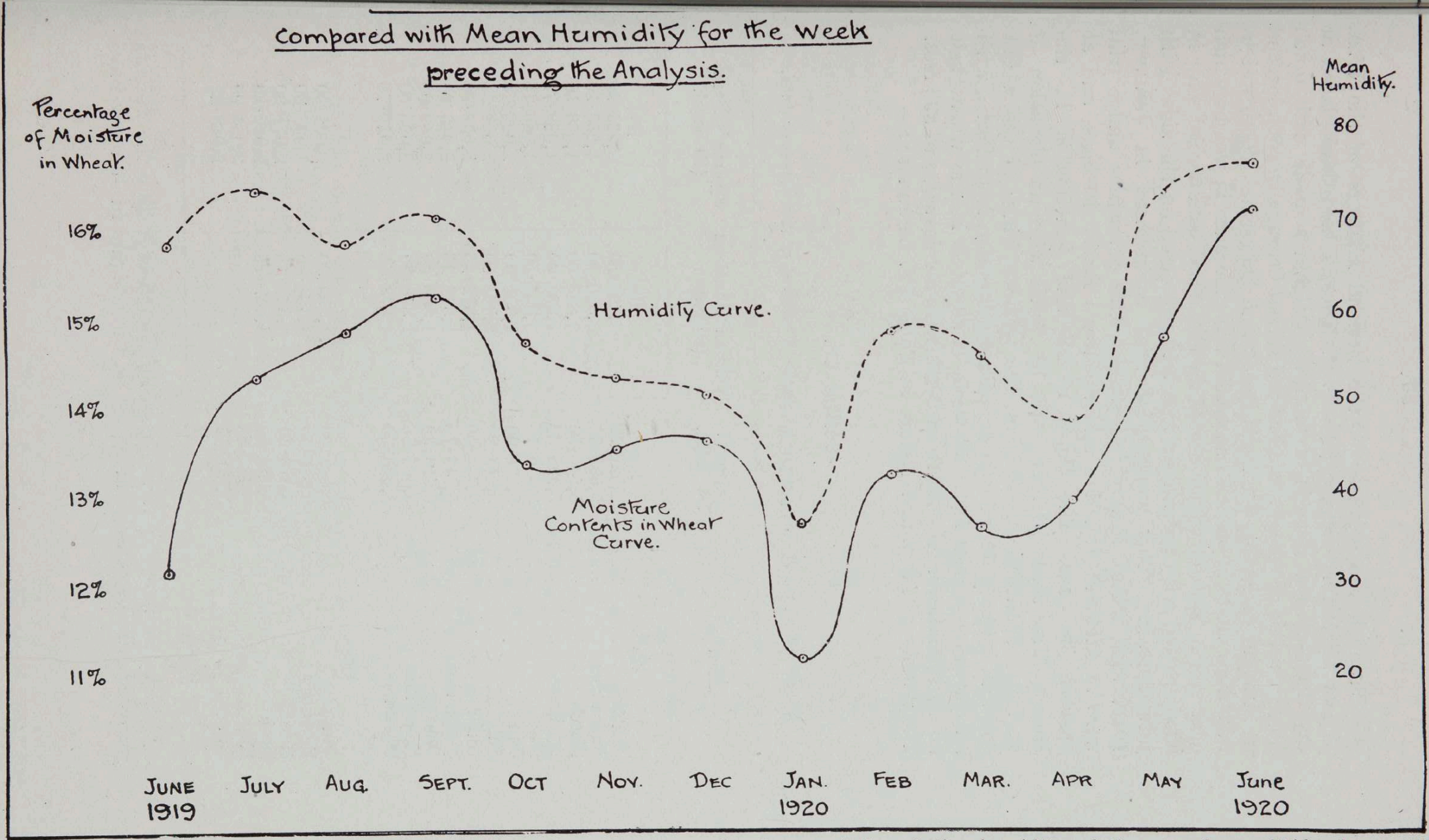
At the conclusion of the yearly period which followed the collection of the samples of wheat it was decided to continue the experiment until the following year so as to have a full period of a year during which to observe the relation of the humidity and moisture content curves to each other. The results of the moisture determinations for February to June, 1920, inclusive, have been included in Table I. and the temperatures and relative humidity for the weekly periods preceding the taking of the samples for the moisture for the full period are shown hereunder in Table III.

TABLE III.

Temperature Readings and Mean Humidity for a period of seven days preceding the Moisture Determination.

Sample of Wheat taken on.	Period.		Dry Bulb.			Wet Bulb.			Mean Humidity for Peri'd
	From.	To.	a.m.	p.m.	Mean.	a.m.	p.m.	Mean.	
June 24, 1919	June 18	June 24	54·2	66·0	60·1	51·1	57·9	54·5	68
July 28, 1919	July 22	July 28	57·7	64·2	61·0	54·9	58·0	56·5	74
Aug. 24, 1919	Aug. 18	Aug. 24	57·6	68·3	63·0	53·4	60·9	57·2	68
Sept. 24, 1919	Sept. 18	Sept. 24	63·1	66·0	64·6	58·7	59·8	59·3	71
Oct. 25, 1919	Oct. 19	Oct. 25	64·6	71·9	68·3	56·8	62·3	59·6	57
Nov. 25, 1919	Nov. 19	Nov. 25	74·1	79·9	77·0	64·5	67·7	66·1	53
Dec. 25, 1919	Dec. 19	Dec. 25	74·9	77·7	76·3	64·3	65·7	65·0	51
1920.									
Jan. 25, 1920	Jan. 19	Jan. 25	88·1	98·7	93·4	71·4	76·8	74·1	37
Feb. 25, 1920	Feb. 19	Feb. 25	75·3	82·6	79·0	67·2	71·2	69·2	59
March 26,1920	Mar. 20	Mar. 26	75·7	87·0	81·3	68·3	72·4	70·3	55
April 25, 1920	April 19	April 25	70·0	84·9	77·5	60·0	70·3	65·2	48
May 25, 1920	May 19	May 25	58·9	68·9	63·9	55·9	62·0	58·9	73
June 25, 1920	June 19	June 25	56·1	63·3	59·7	53·3	58·2	55·7	76

From the details in Tables I. and III., the curves in Fig. XII. have been prepared. From these it will be seen that the comparative sympathy found between the two curves in the first period, June, 1919, to January, 1920, is continued during the second period, January to June, 1920, thus confirming the conclusions already advanced.



Curves showing the relation between the moisture content of wheat and the relative humidity of the air, June, 1919—June, 1920.

Through the courtesy of the General Manager of the W.A. Wheat Marketing Scheme (Mr. F. C. Keys) I have had placed at my disposal the records of monthly weighings made with much larger parcels of wheat stored at the Wheat Storage Depôts, located at Midland Junction, Spencer's Brook and Dowerin. These weighings were made in order to ascertain the difference in weight which occurred in sacked wheat stored in the usual commercial way in sheds roofed with galvanised iron and protected on the sides with jute curtains. This commercial trial commenced in January, 1919, with wheat freshly harvested. The quantities under trial were at Midland Junction and Spencer's Brook 10 bags, and at Dowerin 30 bags. The Depôt at Midland Junction is in the Metropolitan area, 10 miles east of Perth with an elevation of 46 feet. Spencer's Brook is on the western fringe of the wheat belt and is about 50 miles in an easterly direction from Perth, with an elevation of 520 feet. Dowerin is situated in the wheat belt about 100 miles north-east from Perth with an elevation of 896 feet. The results of the weighings are in Table IV. hereunder :—

TABLE IV.

Results of Monthly Weighings of Sacks of Wheat at the depots named.

Month.	Dowerin (30 bags).	Midland Junction (10 bags).	Spencer's Brook (10 bags).
1919.	lbs.	lbs.	lbs.
January	5,526·50	1,797·50	1,934·50
February	5,526·75	1,820·00	1,955·50
March	5,546·50	1,828·00	1,956·50
April	5,606·00	1,838·00	1,966·75
May	5,626·75	1,847·50	1,985·75
June	5,674·00	1,855·00	2,008·75
July	5,713·00	1,865·50	2,021·25
August	5,744·00	1,872·25	2,038·50
September	5,743·75	1,872·25	2,043·00
October	5,718·50	1,880·50	2,049·00
November	5,696·75	1,879·50	2,035·50
December	5,660·50	1,873·75	2,029·75
1920.			
January	5,584·00	1,859·00	2,004·00
February	5,594·50	1,854·25	1,999·00
March	5,6[illegible]3·50	1,851·25	2,011·00
April	5,637·50	1,847·75	2,027·50
May	5,662·50	...	2,0[illegible]4·00
June	5,721·75	...	2,048·25

So as to have a common basis for comparison from the weights recorded, the percentage increases on the weights in January have

been calculated and together with the percentage increases of the small experimental lots are shown in Table V. hereunder :—

TABLE V.

Percentage of Moisture absorbed by Wheat in Bags at various depots.

(Based on January, 1919 = 0).

—	Dowerin.	Midland Junction.	Spencer's Brook.	Perth Experimental Lots.
1919.				
January	·00	·00	·00	·00
February	·005	1·25	1·09	...
March	·362	1·70	1·14	...
April	1·44	2·25	1·67	...
May	1·81	2·18	2·65	...
June	2·67	3·20	3·84	2·81
July	3·37	3·78	4·48	4·96
August	3·94	4·16	5·38	5·48
September	3·93	4·16	5·61	5·88
October	3·47	4·62	5·92	3·99
November	3·08	4·56	5·22	4·16
December	2·42	4·24	4·92	4·24
1920.				
January	1·04	3·42	3·59	1·82
February	1·23	3·16	3·33	3·87
March	1·76	2·99	3·95	3·28
April	2·01	2·80	4·81	3·61
May	2·46	*	4·62	5·32
June	3·53	...	5·88	6·71

* Depot emptied prior to this date.

These trials show that wheat increases in weight during the wet winter months, and decreases during the dry months. In no case was the decrease sufficient to bring the weight back to that of the freshly harvested grain. As might be expected, the increase in the drier atmosphere of Dowerin was less than that at the more humid places. It is however, difficult to understand with the data available why the maximum percentage increase under the more humid conditions at Midland Junction was so much less than at the higher and drier locality at Spencer's Brook.

The maximum increase at Spencer's Brook, 5·92 per cent. approximates the maximum increase, 5·88 per cent., obtained a month earlier with the smaller quantities of wheat at Perth. The trials at the Storage Depots confirm the results obtained in the experiment with the smaller quantities of wheat and are specially interesting in that they have been obtained in a commercial way with bulk parcels.